

ROUND 5

TOSS-UP

1) ENERGY *Multiple Choice* Bioplastics are plastics derived from plant sources, rather than petroleum. Which of the following is NOT a way in which bioplastics can be made?

- W) Intracellular production by the fermentation of a feedstock
- X) Engineering a crop to grow the plastic within the plant itself
- Y) Fermentation of a cereal to make precursors, which would then be processed into bioplastics
- Z) Fermentation of the waste water from the conventional manufacture of corn syrup

ANSWER: Z) FERMENTATION OF THE WASTE WATER FROM THE CONVENTIONAL MANUFACTURE OF CORN SYRUP

BONUS

1) ENERGY *Multiple Choice* Which of the following is NOT an accurate representation of a limitation on the production and use of bioplastics?

- W) Using crops to produce plastic diverts plants from the food supply
- X) Bioplastics are unlikely to disintegrate in a landfill
- Y) Bioplastics produce a variety of pollutants when burned
- Z) Individuals at home would find it difficult to compost bioplastics

ANSWER: Y) BIOPLASTICS PRODUCE A VARIETY OF POLLUTANTS WHEN BURNED

TOSS-UP

2) CHEMISTRY *Short Answer* Name the following compound: N_2O_4 .

ANSWER: DINITROGEN TETROXIDE (ALSO ACCEPT: NITROGEN TETROXIDE, NITROGEN PEROXIDE)

BONUS

2) CHEMISTRY *Short Answer* What is the equation for the combustion of octane?

ANSWER: $2C_8H_{18} + 25O_2 \longrightarrow 18H_2O + 16CO_2$

TOSS-UP

3) MATH *Multiple choice* Psoriasis, a chronic skin disorder caused by the immune system, affects 1% to 2% of Caucasians. If there are 16,098,000 Caucasians in New York State, about how many would be expected to have psoriasis?

- W) Between 16,000 and 32,000
- X) Between 160,000 and 325,000
- Y) Between 1,600,000 and 3,220,000
- Z) 241,470

ANSWER: X) BETWEEN 160,000 AND 325,000

BONUS

3) MATH *Short Answer* What is 224% of 17? Provide your answer as a decimal to the nearest integer.

ANSWER: 38

TOSS-UP

4) PHYSICS *Multiple Choice* When we measure the distance traveled by an object moving from one point to another, which of the following is always true?

- W) Magnitude of displacement is greater than or equal to distance
- X) Magnitude of displacement equals distance
- Y) Magnitude of displacement is greater than distance
- Z) Magnitude of displacement is less than or equal to distance

ANSWER: Z) MAGNITUDE OF DISPLACEMENT LESS THAN OR EQUAL TO DISTANCE

BONUS

4) PHYSICS *Short Answer* José and Rosie were spelunking in the caves in the Black Hills of South Dakota. They crawled through a multitude of passages, traveling a net 3 kilometers westward, 4 kilometers south, and 50 meters up. What was magnitude of their overall displacement to the nearest kilometer?

ANSWER: 5

TOSS-UP

5) EARTH AND SPACE *Multiple Choice* In the last 4 billion years, the average brightness of the Sun has:

- W) Increased
- X) Decreased
- Y) Stayed the same
- Z) Increased, then decreased

ANSWER: W) INCREASED

BONUS

5) EARTH AND SPACE *Short Answer* What are explosive events associated with sunspots that cause spectacular auroras in Earth's upper atmosphere near its magnetic poles?

ANSWER: SOLAR FLARES

TOSS-UP

6) PHYSICS *Short Answer* The Lorentz force acting on a particle moving in electric and magnetic fields depends on what two characteristics of the particle?

ANSWER: CHARGE AND VELOCITY (DO NOT ACCEPT: SPEED)

BONUS

6) PHYSICS *Short Answer* The interior light in a car is left on for three hours. The light draws 1 ampere from the battery. How many coulombs flowed through the light?

ANSWER: 10,800

TOSS-UP

7) ENERGY *Multiple Choice* Where is most of the uranium used in the United States mined?

- W) United States
- X) Middle East
- Y) Africa
- Z) South America

ANSWER: W) UNITED STATES

BONUS

7) ENERGY *Short Answer* Uranium is usually found in trace concentrations, so it generally has to be extracted from uranium ore. Name the term for concentrated uranium oxide, which can vary in color from yellow, orange, and dark green to brown and black, produced from uranium ore in the uranium recovery process.

ANSWER: YELLOWCAKE (ACCEPT: U_3O_8 , TRIURANIUM OCTOXIDE)

TOSS-UP

8) MATH *Short Answer* For which values of g is the following inequality true: $6g + 4 > 9g - 11$?

ANSWER: $g < 5$

BONUS

8) MATH *Multiple Choice* If $f(x)$ (read as: f of x) represents the function whose graph is the standard normal distribution curve, then how do the inflection points on the curve for $2f(x)$ (read as: $2f$ of x) compare to those of $f(x)$?

- W) Both curves have the same inflection points
- X) The $2f(x)$ inflection points are twice as far apart but the same height
- Y) The $2f(x)$ inflection points are twice as high but the same distance apart
- Z) The $2f(x)$ inflection points are both twice as far apart and twice as high

ANSWER: Y) THE $2F(X)$ INFLECTION POINTS ARE TWICE AS HIGH BUT THE SAME DISTANCE APART

TOSS-UP

9) ENERGY *Multiple Choice* Which of the following forms of energy does NOT require bulk motion of physical matter through space?

- W) Radiant
- X) Nuclear
- Y) Electrical
- Z) Hydropower

ANSWER: W) RADIANT

BONUS

9) ENERGY *Short Answer* Ionizing radiation, which can penetrate cells and create ions in cell contents, is generated by which two kinds of electromagnetic radiation?

ANSWER: X-RAYS AND GAMMA RAYS

TOSS-UP

10) EARTH AND SPACE *Multiple Choice* Which of these atmospheric layers is furthest from the Earth's surface?

- W) Stratosphere
- X) Mesosphere
- Y) Thermosphere
- Z) Troposphere

ANSWER: Y) THERMOSPHERE

BONUS

10) EARTH AND SPACE *Short Answer* What is the name of the atmospheric layer that is the closest to the ground?

ANSWER: TROPOSPHERE

TOSS-UP

11) BIOLOGY *Multiple Choice* Spiders can build webs without a parent showing them how, and baby birds can beg for food from the moment they are hatched. These are examples of:

- W) Imprinting
- X) Stimulus and response
- Y) Instinct
- Z) External motivations

ANSWER: Y) INSTINCT

BONUS

11) BIOLOGY *Multiple Choice* Honeybees leave the hive to find food. Upon finding food, honeybees return to the hive and dance to tell others how to find the food. This behavior is an example of:

- W) Classical conditioning
- X) Migration
- Y) Insight learning
- Z) Visual communication

ANSWER: Z) VISUAL COMMUNICATION

TOSS-UP

12) MATH *Short Answer* Solve the following equation for x : $\log_2 x = 5$ (read as: log base 2 of x equals 5).

ANSWER: 32

BONUS

12) MATH *Short Answer* Consider the polynomial $5x^2 + 13x + 10$. How many and what kind of roots does it have?

ANSWER: TWO COMPLEX ROOTS

TOSS-UP

13) EARTH AND SPACE *Multiple Choice* Which of the following is NOT a greenhouse gas?

- W) Helium
- X) Methane
- Y) Carbon dioxide
- Z) Water vapor

ANSWER: W) HELIUM

BONUS

13) EARTH AND SPACE *Short Answer* There are many sources and sinks on Earth for carbon dioxide. Give the most biologically significant source and sink, respectively.

ANSWER: RESPIRATION AND PHOTOSYNTHESIS (IN THIS ORDER) ALSO ACCEPT:
SOURCE IS RESPIRATION AND SINK IS PHOTOSYNTHESIS (IN ANY ORDER)

TOSS-UP

14) MATH *Multiple Choice* If 14 is a factor of the whole number x , which of the following also must be a factor of x ?

- W) 4
- X) 7
- Y) 10
- Z) 28

ANSWER: X) 7

BONUS

14) MATH *Short Answer* What is the point of intersection of these two lines:
 $y = -2x + 3$ and $y = 3x - 7$?

ANSWER: (2, -1)

TOSS-UP

15) CHEMISTRY *Short Answer* What is standard temperature, in Kelvin, as defined in ideal gas equations?

ANSWER: 273 KELVIN

BONUS

15) CHEMISTRY *Multiple Choice* To calculate the pressure within a known volume of gas, which of the following pieces of information is NOT needed?

- W) Temperature
- X) Specific gravity
- Y) Moles of gas
- Z) Gas constant

ANSWER: X) SPECIFIC GRAVITY

TOSS-UP

16) PHYSICS *Short Answer* Lynne is standing still on a sidewalk. What is the name of the concept which describes why the siren of an approaching fire truck has a higher frequency than that of a fire truck that is stopped?

ANSWER: DOPPLER SHIFT (ACCEPT: DOPPLER EFFECT)

BONUS

16) PHYSICS *Short Answer* Which theory attempts to unify physics by producing all known forces and particles as different vibrations of a single substance?

ANSWER: STRING THEORY

TOSS-UP

17) EARTH AND SPACE *Short Answer* A map composed of constant elevation lines is known as what kind of map?

ANSWER: TOPOGRAPHIC

BONUS

17) EARTH AND SPACE *Multiple Choice* What quality is represented by isobars when looking at a weather map?

- W) Pressure
- X) Temperature
- Y) Cloud height
- Z) Water vapor content

ANSWER: W) PRESSURE

TOSS-UP

18) BIOLOGY *Multiple Choice* When you touch a hot object and quickly draw your hand away, this is known as:

- W) The withdrawal impulse
- X) The withdrawal reflex
- Y) A reflexive habit
- Z) Learned withdrawal

ANSWER: X) THE WITHDRAWAL REFLEX

BONUS

18) BIOLOGY *Multiple Choice* A withdrawal reflex is initiated by skin receptors that detect external stimuli. The sensory neurons then pass the message on to the spinal cord, where the sensory nerve terminals synapse with which of the following?

- W) Synaptic neurons
- X) Intersynapses
- Y) Sensory synapse
- Z) Interneurons

ANSWER: Z) INTERNEURONS

TOSS-UP

19) CHEMISTRY *Short Answer* What best describes a solid whose atoms are arranged in a regular pattern?

ANSWER: CRYSTAL

BONUS

19) CHEMISTRY *Multiple Choice* The unit cell in a crystal system may have one of several forms. Which of the following describes a cubic unit cell with one identical particle in the center of the cell?

- W) Simple cubic
- X) Orthohombic
- Y) Triclinic
- Z) Body-centered cubic

ANSWER: Z) BODY-CENTERED CUBIC

TOSS-UP

20) BIOLOGY *Multiple Choice* Adenosine triphosphate (ATP) and glucose are both examples of substances containing what kind of energy?

- W) Heat
- X) Kinetic
- Y) Chemical
- Z) Mechanical

ANSWER: Y) CHEMICAL

BONUS

20) BIOLOGY *Short Answer* What happens when the third phosphate group is removed from ATP by hydrolysis, forming ADP and phosphate?

ANSWER: ENERGY IS RELEASED

TOSS-UP

21) PHYSICS *Multiple Choice* What is the process by which nuclear fission produces energy?

- W) Combining lighter nuclei into heavier nuclei
- X) Increasing the number of protons a nucleus contains
- Y) Changing an electron's spin state following excitation
- Z) Splitting heavier nuclei into lighter nuclei

ANSWER: Z) SPLITTING HEAVIER NUCLEI INTO LIGHTER NUCLEI

BONUS

21) PHYSICS *Multiple Choice* Which of the following is NOT a challenge in using nuclear fusion as a controlled generator of power?

- W) The fuels needed for fusion reactions are expensive and difficult to find
- X) Containing the reaction once it has started is difficult
- Y) Materials used to contain fusion reactions are affected by the high radiation levels
- Z) Extremely high temperatures are needed to start the reaction

ANSWER: W) THE FUELS NEEDED FOR FUSION REACTIONS ARE EXPENSIVE AND DIFFICULT TO FIND

TOSS-UP

22) EARTH AND SPACE *Multiple Choice* The core of the Earth is primarily made of iron and which additional element?

- W) Mercury
- X) Nickel
- Y) Zinc
- Z) Barium

ANSWER: X) NICKEL

BONUS

22) EARTH AND SPACE *Short Answer* Put the following terms in order from the center of the Earth to the surface: mantle, crust, outer core, inner core.

ANSWER: INNER CORE, OUTER CORE, MANTLE, CRUST

TOSS-UP

23) MATH *Short Answer* What is $\frac{3}{4} + (-\frac{5}{6})$ as a fraction in simplest form?

ANSWER: $-\frac{1}{12}$

BONUS

23) MATH *Multiple Choice* Which of the following numbers is relatively prime with 15?

- W) 348
- X) 350
- Y) 352
- Z) 354

ANSWER: Y) 352

TOSS-UP

24) BIOLOGY *Short Answer* What is the name for a segment of DNA that carries instructions for synthesizing proteins?

ANSWER: GENE

BONUS

24) BIOLOGY *Short Answer* What process is best described as the fusion of gametes to produce a new organism?

ANSWER: FERTILIZATION

TOSS-UP

25) CHEMISTRY *Short Answer* A pH of 2 has what pOH?

ANSWER: 12

BONUS

25) CHEMISTRY *Short Answer* If the electromotive force of the anode in a galvanic cell is -0.76 volts and the electromotive force of the cathode is 0.34 volts, calculate the electromotive force of the cell in volts. Provide your answer as a decimal to the nearest hundredth.

ANSWER: +1.10 (DO NOT ACCEPT: -1.10)